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Article abstract

Large amounts of geologic field data have been produced as a result of recent geologic investigations by the New Brunswick Department of Natural Resources, financed by the Federal Department of Regional Economic Expansion. This necessitated designing a standardized system for the collection, storage and retrieval of geologic field data, which is briefly described in this report.



Collection, Storage and Retrieval of Geological Field Data in Precambrian and Paleozoic Rocks of Southern New Brunswick

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Summary

Large amounts of geologic field data have been produced as a result of recent geologic investigations by the New Brunswick Department of Natural Resources, financed by the Federal Department of Regional Economic Expansion. This necessitated designing a standardized system for the collection, storage and retrieval of geologic field data, which is briefly described in this report.

Introduction

Vast amounts of geologic data produced as a result of recent geologic investigations by the New Brunswick Department of Natural Resources necessitated the use of a standardized system for data collection adapted to computer processing. This system was designed to: 1) insure collection of all pertinent field data, 2) reduce subjectivity in observations and recording, 3) improve efficiency of data processing.

Our system can incorporate typical lithologic and structural data of deformed Precambrian and Early Paleozoic metasedimentary, volcanic and intrusive rocks in New Brunswick. We suggest, moreover, that our method can be applied, with possible minor modifications, to tectonites in other parts of the northern Appalachians.

Other systems for computer storage and retrieval of geologic field data have been developed for regional surveys in Manitoba (Haugh *et al.*, 1967), British Columbia (Hutchison and Rodderick, 1968) and Quebec (Wynne-Edwards *et al.*, 1970). These systems were not amenable for typical field data in the northern Appalachians of New Brunswick.

Our field data have been collected in a standardized format (Fig. 1). Common lithologic and structural data as well as standard reference information were recorded in coded form (Table I). Other pertinent data were incorporated in additional notes. Emphasis was placed on structural data because most rocks in the area have been subjected to intense polyphase deformation. The field sheet has been designed for easy transfer to I.B.M. punch cards for

retrieval and processing. Our present system has been used successfully for four years. We hope that the following description of our method will be helpful to other geologists working in the northern Appalachians.

The senior author designed the data and code sheets with assistance of D. S. Secord, S. M. Buttimer, B. Jones and D. V. Venugopal. The computer program was written by D. S. Secord and it was partly modified and tested in detail by J. Chandra, as shown in this report. Professor David Bonyon of Acadia University assisted by converting his general purpose computer program to produce stereo net diagrams (Bonyon and Stevens, 1970) for punched output of our structural data.

Description of Data Sheet

This standard data sheet (Fig. 1) is divided into four sections: 1) Location and general reference, 2) Lithologic descriptions, 3) Structure, and 4) Description of sample data, formational names, geologic age and available additional data.

Location and General Reference Section. Outcrops with fundamental lithologic and structural data have been plotted on base maps

	Code	Explanation		Code	Explanation		
Lithology	RT	Rhyolite, Duff	Minerals and/or Rock Types	VF	Volcanic Fragments		
	ST	Sandstone		QZ	Quartz		
	SK	Siltstone		MX	Matrix		
	DB	Diabase		MC	Mafics (undifferentiated)		
	GT	Granite		FC	Feldspar (undifferentiated)		
Colour and Value	MR,1	Maroon, Mottled	FP	Plagioclase			
	MR,N	Maroon, Medium	FS	Potash feldspar			
	GG,M	Grey-green, Medium	QT	Quartzite			
	GN,D	Green, dark	RY	Rhyolite			
Further description	R	Interbedded	Alteration	C	Chlorite		
	K	Dyke		E	Epidote		
Grain Size	I	Intrusive	Metallization	HD	Hematite, disseminated		
	M	Medium (1-5 mm)		NV	Hematite, vein		
	F	Fine (0.1-1 mm)		PD	Pyrite, disseminated		
Texture (Primary)	V	Very Fine (< 0.1 mm)	Cleavage or Schistosity	A	Slaty cleavage		
	19	Porphyroclastic		C	Granulation cleavage		
	04	Moderately sorted		B	Fracture cleavage		
	08	Well sorted					
Texture (deformation)	34	Porphyritic	Veins	A	Metallized		
	01	Granular					
Linear Structure	1	Cataclastic	Sills or Dykes	A	Diabase		
				Bedding Tops	K	Unknown	
					U	Up	
					Faults	D	Sextral
Minor Folds	1	Asymmetrical (S-shaped)	Joints	S	Slip		
	2	Symmetrical		U	Unclassified		
	3	Asymmetrical (Z-shaped)		E	Extension		
Fold Group	1	Close to isoclinal folds with penetrative axial plane cleavage					
	2	Open to tight folds which have deformed bedding (S ₀) and cleavage (C ₁)					
	3	Chevron folds which have deformed structures of Group 1 and 2					

Table I
 Codes used in Figure 1.

MINERAL RESOURCES BRANCH, SOUTHERN NEW BRUNSWICK

Card No. Field Map No. **P28** o/c No. **B027** Card No. Field Map No. o/c No. appear in the first 8 columns of each card

Air Photo No. **514-0214** Geologist **RPM** Date **280771** Project No. **9315**

o/c Location Longitude **654840** Latitude **452207** o/c Dimensions Length **0030** Width **0020**

o/c Orientation **030** Correlative Field Map No. **Q27** o/c No. **0014** END CARD 0

LITHOLOGY CARD 1						NOTES									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rock Type	RT	ST	SN	DB	GT	CARD 8 Subject Code G T H E I S									
Percentage	10	30	40	05	15	RANITE									
Colour & Value	MRT	MRT	GGM	GND	GGM	INTRUDED									
Further Description	B	B	B	K	I	Y THE DIAB									
Grain Size	M	F	V	F	M	ASE - THE RH									
Texture Prim & Metam END CARD 1 Deformation	19	09	08	04	01	YOLITE TUF									
Minerals & Percent	VF 4	QE 5		FP 2	MU 2	AK EU END CARD 8									
And/Or	FU 1	QT 4		MX 8	FK 2	CARD 9 TAXITIC									
Rock Types & Percent (if Detrital)	MX 4	RL 1			FP 4	FOLIATION									
Alteration Product	QZ 1				QZ 2	WHICH HAS									
Metalization & Description	HD	HV		FD		BEEEN RECO									
						RDED UNDER									
						FLOW STRU									
						CTURE END CARD 9									

PLANAR STRUCTURE	BEDDING			LAMINATION			FLOW STR			CLEAVAGE or SCHISTOSITY			BANDING or GNEISSOSITY			VEINS			SILLS or DYKES		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Info	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Strike	013	049	139	032	112	134										175	132				
Dip	60S	40N	47S	71N	80S	30N										80S	88S				
Rel Age				1	2	3										1	1				
Topo	U	K	K																		

FAULTS	LINEAR STRUCTURE CONT CD 6		
	1	2	3
Info	1	1	1
Strike	08E	178	
Dip	20S	60N	
Rel Age	1	2	
Str. Pch END CD 5 Sense	07S	80N	
	D	D	

MINOR FOLDS CARD 7	AXIAL PLANE			AXIS		
	1	2	3	4	5	6
Symmetry	3	1	2			
Closure	3	1	2			
Strike	112	032	134			
	80S	71N	30N			
Dip	281	026	114			
	50	18	10			
Group	1	2	3			

JOINTS CARD 6	AXIAL PLANE			AXIS		
	1	2	3	4	5	6
Type	S	U	E			
Strike	140	114	050			
Dip	88S	24E	75N			
Intensity	04	05	10			

CONT. CD 7 ³¹ Grab Sample ³² Oriented Sample ³³ Mineralized Sample ³⁴ Chip Sample ³⁵ Fossil ³⁶ Chemical Analysis Bulk ³⁷ Specific ³⁸ Thin Section

³⁹ Polished Section ⁴⁰ Photo ⁴¹ Formation Name **CB** ⁴² Age **PC** ⁴³ Additional Data END CARD 7

Figure 1
Field Data Sheet.

(scale one inch equals one quarter mile), which are designated by a letter and two-digits (card 0 – columns 2-4). Outcrops have been identified by a letter code assigned to each geologist (column 5) and a number (columns 6-8). Outcrop locations are determined on air photos which are designated by flight and photo numbers respectively, (columns 9-16). The name of the geologist, date and project number are indicated in columns 17-29. The following sections describe the outcrop location by longitude and latitude (columns 30-41), the dimension, and orientation (columns 42-52). A possible correlation of the lithologies comprising the outcrop with a standard section (columns 53-59) is indicated if the relationship is known.

Lithology. The upper part of this section (card 1) makes provision for recording five lithologies (columns 9-18), relative amounts of each (columns 19-28), colour (columns 29-43), contact relationships between various lithologies (columns 44-48), grain size (49-53) and texture (54-63). Presence of deformational effects is indicated by placing the number "1" in the appropriate column (64-68).

The central part of this section indicates the relative amounts of minerals and rock fragments for various rock types (card 2 – columns 9-80 and card 3 – columns 9-11). The lower part of this section (card 3) indicates rock alteration (columns 12-26), metallic minerals and mode of occurrence (columns 27-56). Additional information about these are usually given in the notes (cards 8 and 9).

Structure. This section is divided into two parts: a) Planar structures and b) Linear structures.

In the sub-section on planar structures, the blocks near the top of each column (card 3 – columns 57-67) indicate the presence (referred to by the number "1") and/or nature (indicated by a letter) of various types of planar structures. Below these, provision has been made to indicate strike (card 4 – columns 9-41), dip angles and directions (columns 42-74) and relative ages of various structures which are indicated by

numbers (card 5 – columns 12-19). Faults are recorded in a similar fashion (card 5 – columns 20-35), but, in addition, pitches of striations and sense of movement are indicated (columns 36-43). Joints have been classified into three categories (Fig. 2) and provision has been made for five sets (Fig. 1). In addition to attitudes (card 6 – columns 9-43), the intensity has been indicated in joints per meter (columns 44-53).

Linear structures (Fig. 2 shows a classification of intersection and mineral lineations) are recorded on card 6 – columns 54-74. The geometry (card 7 – columns 9-14) and attitudes (columns 15-47) of folds have been indicated in the next section. Allowance has been made for three groups of folds which can usually be recognized in most polydeformed rocks of the region (columns 48-50). At any particular locale, effects of all types of deformation may not be present, and therefore, where evidence of sequence is lacking the folds have been classified on the basis of style alone.

The remainder of card 7 describes various types of samples collected (columns 51-55), sample preparations (columns 56-60), formational name (columns 61-62), age (columns 63-64) and presence of additional

data is indicated in column 65. Cards 8 and 9 are entirely used for additional field notes.

Data Retrieval

A computer program has been written to store and retrieve geologic and related data. Print out of data is designed to facilitate comparison and manipulation. The following flow chart illustrates the sequence of punched cards in a typical retrieving operation (Fig. 2).

The main program is capable of both full print out or retrieval of part of the data. Figure 3 shows the specification cards in sequence for retrieval purposes.

Acronyms used to construct word codes for the required specifications are described in the following pages.

Description of Retrieval Specification Cards

The retrieval specification card (R.S. Card 1) following the \$GO card shows:

- 1) Type of data required, 2) Location parameter, 3) Lithological parameter, 4) Type of output required for structural data (punch out or print out).

Retrieval specification Card 1 (R.S. Card 1) is shown in Figure 4.

Some examples of the use of R.S. Card 1 are:

- a) STRU, COBO, ROTY, POPL.
Punched output of planar structures (POPL) is required for a rock type (ROTY) (ROTY specified on R.S. Card 4) within certain co-ordinate boundaries (COBO) (COBO specified in R.S. Card 3).
- b) NOTE, PACK, ROTY
Printed output is required for all notes (NOTE) on a particular rock type (ROTY) in the entire data package (PACK). The rock type is specified in R.S. Card 4.

Some examples of R.S. Card 2 are:

- a) PLST, CLSC, 3, A, C, B.
Three types (3, A, C, B) of cleavages (CLSC) are requested under planar structures (PLST). When types are specified by only one letter or one number, the type symbols are placed in columns 13, 16, and 19 (See Figure 5). Print out will be generated even though one of these types is present.

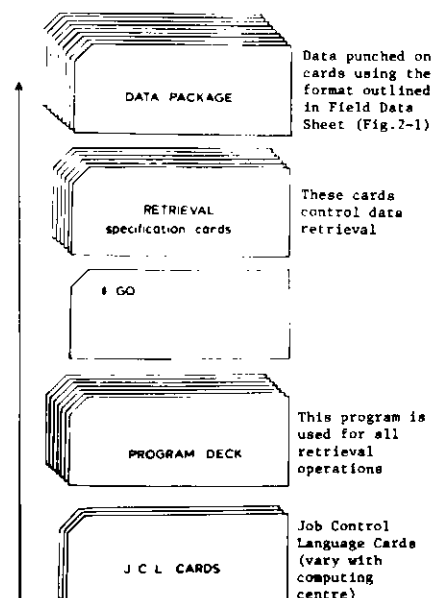


Figure 2
Typical Retrieval Operation Deck.

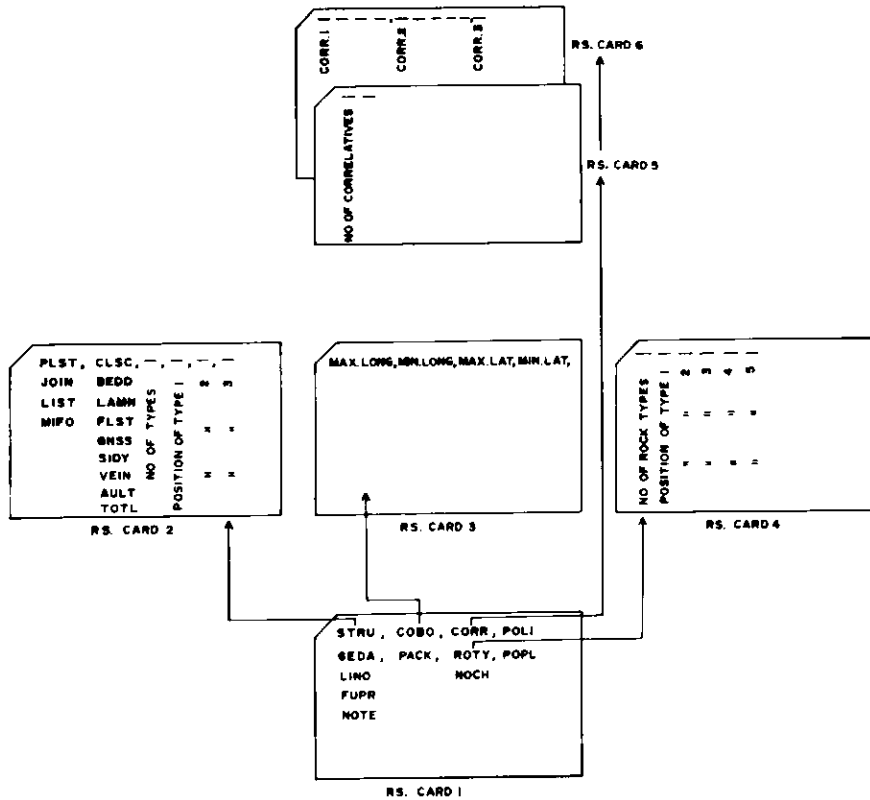


Figure 3
Retrieval Specification Cards.

TYPE OF OUTPUT	CODE	LOCATION PARAM	CODE	LITHOLOGICAL PARAM.	CODE	OUTPUT OPTION(Structure)	CODE
FULL PRINTOUT	FUPR	Coordinate bound- drives	COBO	Rock type (S)	ROTY	Punched output for planar structure	POPL
GENERAL DATA	GEDA	Package (data package)	PACK	Correlative (S)	CORR	Punched output for linear structure	POLI
LITHOLOGY AND NOTES	LINO			No check required	NOCH		
STRUCTURES	STRU					Result in printout of data	(blank)
NOTES	NOTE						

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
F	U	P	R		C	O	B	O		C	O	R	R		P	O	P	L
G	E	D	A		P	A	C	K		R	O	T	Y		P	O	L	I
L	I	N	O							N	O	C	H					
S	T	R	U												b	b	b	b
M	O	T	E															

Figure 4
Retrieval Specification Card 1.
(b = blank space).

- b) LIST, TOTL, 3, 01, 04, 06
A total (TOTL) check is requested for three types (3, 01, 04, 06) of linear structures (LIST).
- c) MIFO, TOTL, 3, 1, 2, 3
A total (TOTL) check is made for three types (3, 1, 2, 3) of minor folds (MIFO).

The use of R.S. Card 3 is shown in Figure 6. The code COBO, representing co-ordinate boundaries, restricts the computer to a part of the data deck within certain geographic boundaries indicated by maximum and minimum latitudes and longitudes. The computer can also be requested to read through the entire

data package by using the acronym PACK in R.S. Card 1. In this case, the use of a COBO specification card (R.S. Card 3) is unnecessary.

Figure 7 illustrates the use of R.S. Card 4 which specifies only rock types (ROTL). When no check is required for any particular rock type the acronym NOCH is used in R.S. Card 1. This eliminates the use of card 4 as shown in Figure 4.

In order to specify correlatives (CORR), R.S. Card 5 and R.S. Card 6 (Figure 8) are used in place of R.S. Card 4. A maximum of 10 correlatives may be specified.

Examples of Retrieval Operations

Data from the Field Sheet (Fig. 1) was used to generate these results. The examples (Table II) show the sequence of retrieval specification cards and the printed/punched result.

Conclusions

Our computer oriented method of geologic data collection, storage and retrieval has the following advantages over conventional methods:

- 1) It provides for accurate collection of all pertinent geologic field data.
- 2) Subjectivity of standard geologic observations is greatly reduced, while provision for additional notes and sketches allows for sufficient flexibility of the system.
- 3) Training of new geologists and senior students has been greatly accelerated as a result of this system.
- 4) Editing and correlation of geologic data collected by large numbers of observers is greatly facilitated.
- 5) Punched output of various types of geologic data can be produced rapidly for any part of the area or specified geologic parameter. This greatly accelerates final processing of structural and lithologic data.
- 6) Mineral exploration geologists can rapidly search our data file for mineral occurrences, alteration zones, rock assemblages and structures favorable for deposition of metallic minerals.

STRUCTURAL CATEGORY	CODE	QUALIFIER	CODE
Joints	JOIN	Total	TOTL
Linear structure	LIST	Total	TOTL
Minor folds	MIFO	Total	TOTL
Planar structure	PLST	Bedding	BEDD
		Lamination	LAMN
		Flow structure	FLST
		Cleavage or schistosity	CLSC
		Banding or gneissosity	GUSS
		Sills or dykes	SIDY
		Veins	VEIN
Faults	AULT		

Acknowledgements

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Note. A copy of the computer program and complete code sheet can be obtained from the authors.

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MS received, June 5;
revised June 14, 1974.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
P	L	S	T		B	E	D	D												
J	O	I	N		L	A	M	N												
L	I	S	T		F	L	S	T												
M	I	F	O		C	L	S	C												
					G	N	S	S												
					S	I	D	Y												
					V	E	I	N												
					A	U	L	T												

Figure 5
Retrieval Specification Card 2.

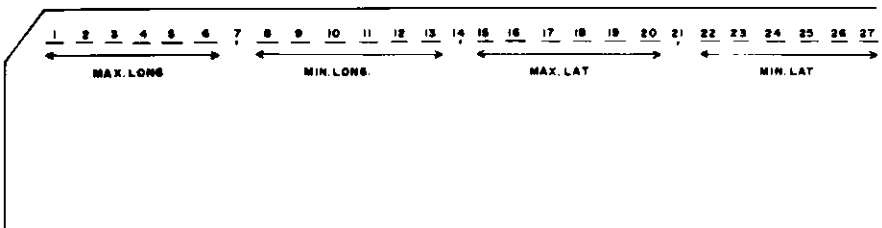


Figure 6
Retrieval Specification Card 3 (COBO).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Figure 7
Retrieval Specification Card 4 (ROTY).

